Identification of Three Species of Reared Hawaiian Fruit Fly Pupae

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INTRODUCTION

In Hawaii, three species of destructive tephritid fruit flies have become established. The melon fly, *Dacus cucurbitae* Coquillett, came in about 1895, the Mediterranean fruit fly, *Ceratitis capitata* (Wiedemann), about 1907, and the oriental fruit fly, *Dacus dorsalis* Hendel, in 1945 (Hardy, 1949). After each invasion, parasites were introduced for biological control, and no difficulty was experienced in assessing the performance of the parasites of the first two species (Back and Pemberton, 1917, 1918). However, after the parasites of the oriental fruit fly were introduced, it was found that although the melon fly was immune to their attacks (Nishida and Haramoto, 1953), the Mediterranean fruit fly was susceptible (Clancy, 1951). Samples of fruit collected in the field and held in bulk yielded many lots of pupae of both *C. capitata* and *D. dorsalis*, together with various parasites of both species. To determine which species of fly had been the host for each of the parasites, a fast, accurate method of identifying the puparia of the three species of flies, before emergence of the parasites or flies, was needed.

METHODS

The conventional approach in species identification is to use only the characters on the main parts and posterior ends of the puparia which remain intact when the flies or parasites emerge, though the anterior parts of the puparia are broken off (Greene, 1921, 1929). However, in determining the species before emergence, all characters on the pupal case, including the anterior ends, may be used.

After studying the characters of the entire puparia of the three species, it was found that although *D. cucurbitae* and *D. dorsalis* can be separated easily enough by using the published descriptions of the posterior ends (Hardy, 1949), *D. dorsalis* and *C. capitata* can be identified only by using some new characters found on the anterior ends of the puparia.

In the latter method, puparia are placed so that the anterior (more pointed) ends are up and the ventral (flatter) sides are toward the

observer. Strips of soft wood drilled with 7/64-inch holes about 5/32-inch deep are helpful for mounting the species to be identified. A good dissecting microscope with 45 to 60 times magnification, and a strong spot light furnishing high, oblique lighting are necessary to bring out the characters.

The following key to the anterior puparial characters is useful in identifying the three species of fruit flies found in Hawaii.

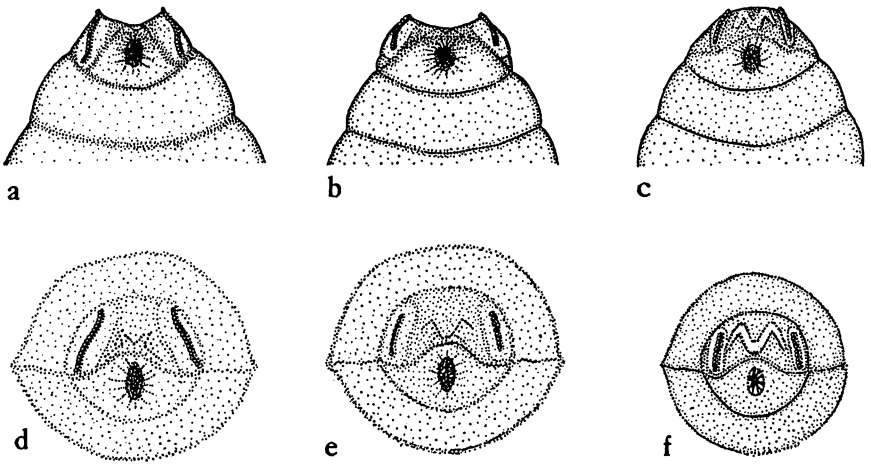

FIGURE 1. **a, b,** anterior ends of *Dacus cucurbitae* and *D. dorsalis* puparia, showing large spiracle bases and concave area between spiracles; **c,** anterior end of *Ceratitis capitata* puparium, showing small spiracle bases, convex area between spiracles, and relatively prominent M-shaped design; **d,** top view of *D. cucurbitae* puparium with long, recurved anterior spiracles and a very faint M-shaped row of pits; **e,** top view of *D. dorsalis* puparium with short anterior spiracles and a faint M-shaped row of pits; **f,** top view of *C. capitata* puparium with short anterior spiracles and a well-defined, colored M-shaped band.

KEY TO PUPARIAL CHARACTERS OF HAWAIIAN TEPHRITID FRUIT FLIES

1. Anterior spiracles long, recurved, with 17 to 24 lobes..... **Dacus cucurbitae**
   Anterior spiracles short, curved, with 9 to 11 lobes.....2

2. Bases of anterior spiracles small, not swollen, height of bases about equal to height of lobes; area between spiracles convex; often with M-shaped, light-colored band between spiracles.. **Ceratitis capitata**

   Bases of anterior spiracles large, swollen, height of bases from one and one-half to two times height of lobes; area between spiracles concave; M-shaped design not present as light-colored band, but may be present as wrinkles or rows of wavy creases, or absent..... **Dacus dorsalis**

DISCUSSION

Over a period of about 7 years, the three species have been segregated by using the characters in the key. The larvae were from more than 50 hosts collected throughout the ranges of these three species of fruit flies. Laboratory-reared pupae were also checked from time to time. Out of 16,475 specimens of the three species segregated in this way, only 10 errors were noted, an indication that an accuracy of 99.9 percent may be achieved by use of this method.

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